# Fall 2014
# SEI Research Review

## Malware Analysis

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

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# The Problem

There is a lot of malicious software

- Hundreds of thousands of new, unique samples collected globally

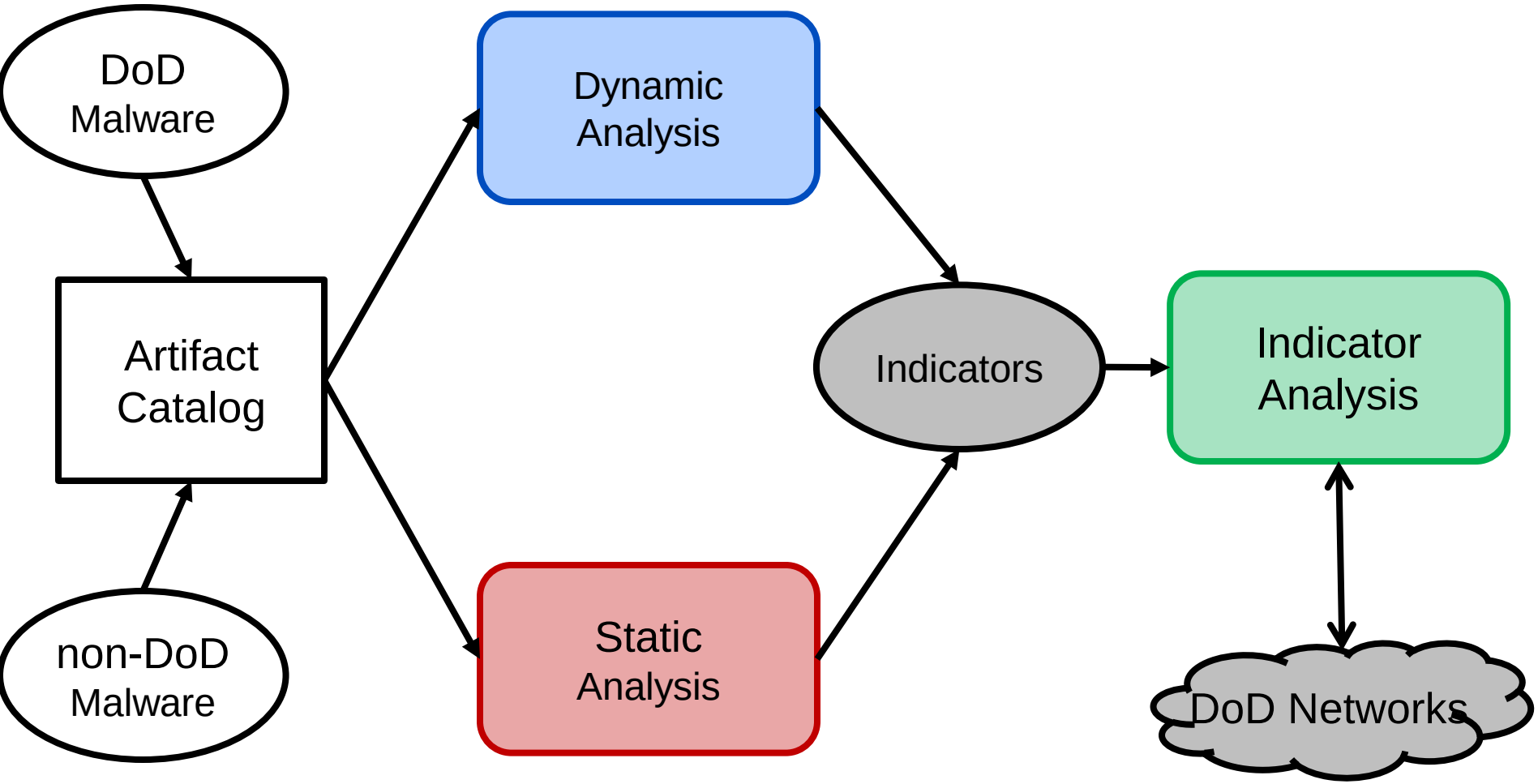
But malware analysis is a time-consuming process

- And human-intensive

So we need better automation to understand the threat.

- Automated static analysis of artifacts
- Large-scale analysis of indicators

# Malware Analysis Process



# Static Analysis Improvements

1. Compiler transformation framework

- ROSE [Quinlan 2000]
- Well-established program analysis technique

Implemented to analyze malware binaries at a larger scale

2. Optimize suffix-tree data structures for the identification of longest common substring (LCS)

We do substring searches a lot, and it takes a long time

Helps with:

- Malicious code analysis (code-clones)
- Zero-suppressed binary decision diagrams (ZDDs) for compact representations of set families.

# Dynamic Analysis Improvements

Malicious Behavior and Model Checking: Describe formally software behavior and be able to determine if the behavior is malicious.

1. Construct an accurate binary instrument for trace capture (trace monitor)
2. Use trace monitor to capture benign and malicious software behavior (collect trace data)
3. Analyze trace data to determine features that link software by behavior.
4. Formally model methods to classify software traces as malicious or benign within the formal language of hyperproperties.

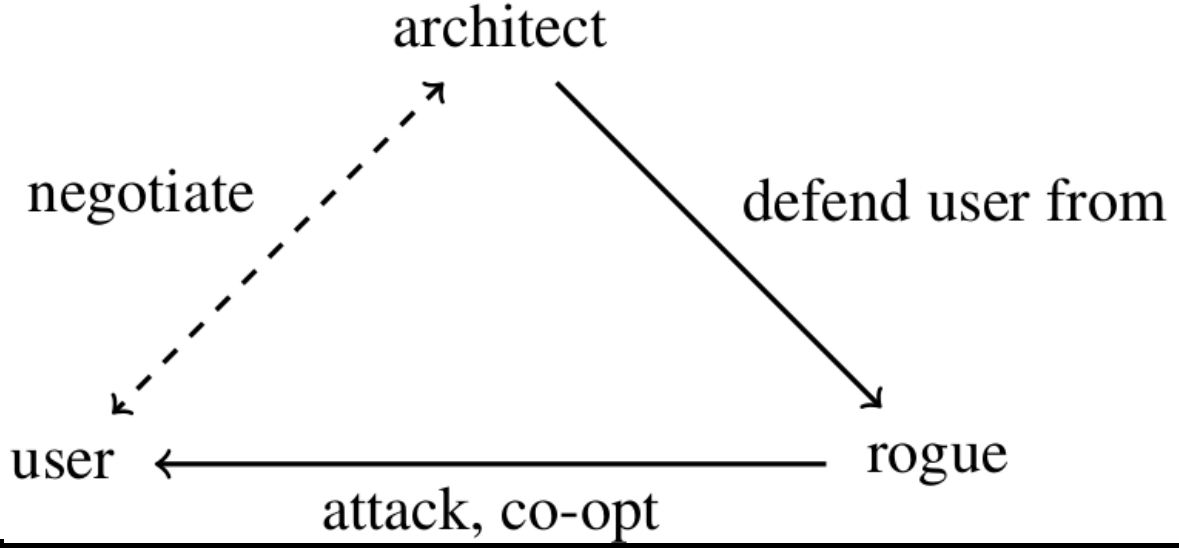
# Indicator Analysis Improvements

## Lead by doing Discovery at Scale

- Passive detection of Misbehaving Name Servers
- Route Injections – What are they good for?
- Everything You Wanted to Know About  Blacklists but Were Afraid to Ask

## Lead by codifying theory and models

- Game theory →
- Metrics
- Take-down models



# Global Improvements

How do we analyze and design observations of engineered artifacts?

Usually, a scientist would turn to philosophy of science to answer methodological questions

But there were no answers in the philosophy literature

- Thus our paper "Exploring a Mechanistic Approach to Experimentation in Computing.“

Computing is new and old

- Newer – study of engineered mechanisms
- Old – study of physical mechanisms

Accommodating these differences presents fundamental challenges we are just unravelling.

# Results

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# Future

This line-funded work was not renewed per se

The work will be continued as:

- Customer-funded deliverables
- New directions within LENS work

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